INSTRUCTION MANUAL

The Rada-Pulser

KAY ELECTRIC COMPANY

14 Maple Ave., Pine Brook, N. J.

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INSTRUCTION BOOK

for the

RADA-PULSER

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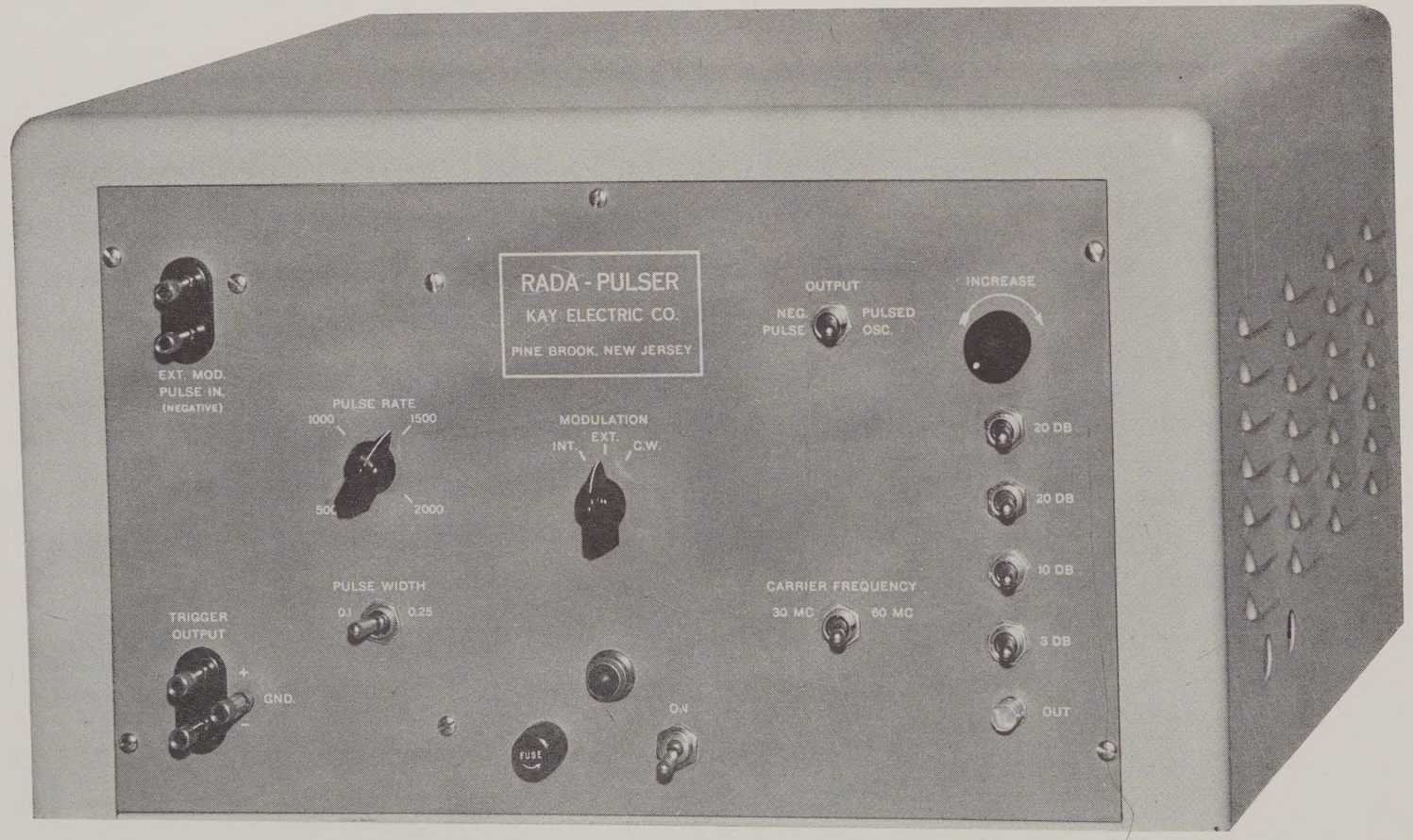

RADA - PULSER
KAY ELECTRIC CO.
PINE BROOK, NEW JERSEY
EXT. MOD. PULSE IN. (NEGATIVE)
PULSE RATE
1000
1500
500
2000
MODULATION
INT.
EXT.
C.W.
OUTPUT
NEG. PULSE
PULSED OSC.
INCREASE
20 DB
20 DB
10 DB
3 DB
OUT
PULSE WIDTH
0.1
0.25
CARRIER FREQUENCY
30 MC
60 MC
TRIGGER OUTPUT
+
GND.
−
FUSE
ON

RADA-PULSER

I. INTRODUCTION

R.F. Cable *not* supplied after March 1, 1960

1. Description.

The Rada-Pulser is a signal generator for use in the transient-response testing of video and I.F. amplifiers, filters, and components. It produces either video pulses, or pulsed wave trains at carrier frequencies normally used for radar I.F. amplifiers. Either type of output wave is characterized by a very wide effective band (short rise and fall times), wider than that of any amplifiers or networks ordinarily encountered, so that all imperfections which appear in the output of the device being tested can ordinarily be attributed entirely to this device and not to the source of the testing voltage.

2. Specifications.

Pulse lengths, 0.1 and 0.25 microsecond.

Pulse repetition rate, 500 to 2000 pps

Carrier frequency, 30 and 60 mcs.

Maximum output voltage, at carrier frequency, 0.5 volt rms; of video pulse, 20 volts peak.

Output impedance, 70 ohms.

Output attenuator, 63 db total. 10 db continuously variable control plus steps of 20, 20, 10, and 3 db.

Effective bandwidth of output, either pulse or carrier, greater than 100 mcs.

3. Notes and comments on the above.

The instrument is normally supplied with the two frequencies of 30 and 60 mcs, either being selectable by means of a panel switch. On special order it can be supplied with any two frequencies in the range 20 to 60 mcs.

Internal adjustments are provided for setting the carrier frequency to the exact value, and for adjusting circuit damping so that flat topped wave trains can be secured.

When the internal pulse generator is used, the repetition rate can be set anywhere in the range 500 to 2000 pps by means of a panel control. Provision is made for the connection of an external pulse generator so that other pulse widths and repetition rates may be used. In this case, however, the perfection (rise and fall times) of the emitted wave trains will depend upon the effective bandwidth of the externally-connected pulse generator, and unless this also has a value of at least 100 mcs, equivalent performance will not be obtained.

A third position on the panel-mounted modulation selector switch permits an unpulsed (C. W.) carrier to be emitted.

The video pulse derived from the internal pulse generator is negative-going only. Where it is possible to use a pulse of this polarity, the Rada-Pulser is an excellent source of voltage for the testing of wideband video amplifiers and networks, due to its own great effective bandwidth.

Trigger pulses are available for initiating the sweep in associated oscillographic equipment. Either a positive or a negative trigger, whose rising edge occurs about 1/4 microsecond ahead of the outgoing pulse, can be obtained from panel terminals.

II. OPERATING INSTRUCTIONS

Plug the line cord into the 110-120 volt 50-60 cycle A. C. line and switch on. Connect the BNC output connector on the panel to the vertical deflection terminals of a good wideband oscilloscope, which should have flat response up to at least 10 megacycles. If such an oscilloscope is not available, it will be necessary to connect directly to the vertical deflection plates on the CR tube, without any intervening amplifier. Connect the "Trigger Output" terminals of the Rada-Pulser to the External Synchronization terminals of the oscilloscope, selecting the polarity required to obtain correct triggering of the sweep. When the "Output" switch on the Rada-Pulser is set to "Neg. Pulse", a negative-going video pulse will be emitted and should be seen on the scope; its amplitude, with all attenuation cut out by throwing the attenuator toggle switches to the left, will be great enough to produce a useful deflection even with direct beam deflection. By connecting the output of the Rada-Pulser alternately to the CR tube directly, and then to the amplifier input, the effect of the amplifier and its gain controls upon the wave shape is readily determined. Either the 0. 1 or the 0. 25 microsecond pulse can be selected, by means of the "Pulse Width" switch on the Rada-Pulser. The output amplitude is the same for the two pulse lengths; if it does not appear to be so after going through an amplifier, this is a measure of the amplifier's response deficiency.

Check to see that both the "Pulse Width" and "Pulse Rate" controls have the proper effect upon the width and repetition rate of the emitted pulse. This completes the check of the pulse-generator and output circuits of the instrument, and if the equipment and technique required to check the wave-form of the pulsed wave trains is not available, no further tests of the instrument are possible; it should be placed into service and used for testing.

If it is desired to check the operation of the pulsed-oscillator portion of the instrument, refer to the special techniques and cautions set forth in Section IV following. Unless these precautions are observed, no adjustments of the oscillator section should be attempted, for if the tuning and damping adjustments are disturbed and the facilities for regaining correct settings are not available, proper operation of the instrument will thereafter be impossible to depend upon.

To obtain pulsed carrier output, throw the "Output" switch to "Pulsed Osc." Maximum output with all attenuation removed is about 0. 5 volt rms. A total of 63 db of attenuation below this level is available; the output impedance is 70 ohms.

III. CIRCUIT DESCRIPTION

1. Pulse Generator

The basic oscillator which generates the pulse-initiating timing wave is a multivibrator employing a 12AT7 tube, VI. A potentiometer, R2, which controls the grid return voltage of the two grid circuits of VI, is calibrated to show the approximate repetition rate, between 500 and 2000 pps. It is possible for the user to alter the repetition rate to any other 1:4 range desired by changing the time constants of the two grid circuits. However, in general, it will not be possible to operate above a top limit of about 4000 pps, due to the deionization time characteristics of the pulse-forming thyratron, V3, and some selection of tubes may have to be done to obtain good operation at the maximum rates.

Instead of using the output of VI to trigger the pulse-forming thyratron directly, a second 12AT7, V2, is interposed to form a high, sharp trigger, as well as to generate both positive and negative triggers for the operation of external equipment. This stage consisting of two tube sections in parallel, is a blocking oscillator which generates a fast-rising pulse a few microseconds long. The positive output is delayed about 1/4 microsecond and used to fire the pulse-forming thyratron V3.

This ia a 2D21 gas tetrode used to discharge an open-ended pulse forming line. The duration of the generated pulse is twice the electrical length of the line used; by switching in a second section of line on the end of the first, the two pulse lengths of 0.1 and 0.25 microsecond are obtained. Additional external lengths of line may be connected in by the user if longer pulses are desired; examination of the circuit diagram will show how this should be done. Some effect upon the maximum obtainable repetition rate must be expected if this change is attempted, and there will have to be some experimentation with the value of the charging resistor, R16, in order to obtain the best compromise between pulse shaping and repetition rate.

The two germanium diodes connected to the plate of the thyratron are used to stabilize the amplitude of the pulse and prevent its changing as the repetition rate is changed.

2. Modulation Control Circuits

The function of the two panel switches marked "Output" and "Modulation" is to set up the circuit conditions required to obtain the various output and pulse characteristics described above. The "Output" switch connects the video pulse from the pulse generator either to the output attenuator so that it may be used directly, or to the "Modulation" switch so that it may be used to modulate the pulsed oscillator. This "Modulation" switch has three positions so that the oscillator may be keyed either from the internal pulse generator or from an external pulse generator, or be left unpulsed so as to emit a continuous wave signal. The characteristics of the oscillator are such that it is suitable only for complete on-off modulation; ordinary linear amplitude modulation is not possible.

3. The R. F. Oscillator

When the oscillator is to be pulsed, with the "Modulation" switch in either the "Int" or "Ext" position, a network containing a germanium diode and a bleeder circuit from B plus is so connected as to throw a heavy (low resistance) load across the oscillator tuned circuit, at the same time causing a current of about ten milliamperes d. c. to flow to ground through the tuned circuit coil. The damping of the tuned circuit is sufficiently heavy to prevent oscillation. When the negative-going pulse arrives, it overpowers the positive d. c. from the B plus, reversing the flow of current through the crystal diode, changing its resistance from a very low to a very high value, and instantly interrupting the current flowing through the tuned-circuit coil. The tuned circuit then begins to oscillate at its natural frequency, in the same manner as does a pendulum, held back at one extreme of its swing, then suddenly released and allowed to take up its natural period of oscillation. As in the pendulum, the oscillator begins immediately at its full oscillating amplitude, provided the release is sufficiently sudden; the first quarter-cycle of the wave is full and undistorted and the output wave when viewed on a sufficiently wide-band oscilloscope will be seen to go instantly from the condition of zero output to the full oscillating amplitude. Also like the pendulum, the aplitude of this oscillator would begin at once to decrease, as the energy stored in the tuned circuit was dissipated, if this energy lose were not constantly replenished. Therefore an oscillator tube, V4, a 6AG7, is connected across the tuned circuit to replace the lost energy. If more than enough energy to replace that lost were added by the tube, the amplitude of the oscillations would build up until overload of the tube occurred; to prevent this, there must be some method of controlling the amount of energy fed back so that the oscillations can be kept at constant amplitude; the obvious way to do this is to control one of the electrode voltages of the tube. However, due to the fact that in this instrument the tube is also being used in electron-coupled fashion to supply the output voltage of the attenuator, this method is undesirable for secondary reasons, and a variable damping resistor is placed across the tuned circuit so that the energy lost can be adjusted to be equal to that supplied by the tube, instead of the other way around. Two such controls, R22 and R23, are provided, one for each operating frequency, so that pulse flatness may be adjusted independently for each of the two carrier frequencies. These controls have been set at the factory and should not be changed by the user unless he employs the techniques and equipment set forth in Section IV following.

When the end of the pulse is reached, the crystal diode in the oscillator grid circuit is brought back to the conducting condition and its resistance again becomes very low, rapidly damping out the oscillations in the tuned circuit. Unfortunately this cannot be done quite as rapidly as can the process of initiating the oscillations by the method of interrupting a d. c. flowing through the coil, and the decay time of the pulse will be found to be about one to two cycles of the carrier frequency. (Note that no definite statements as to rise and decay times are made in these Instructions. This is because the actual times are determined by the carrier frequency; obviously no pulse can rise more rapidly than the first quarter-cycle of the carrier wave. Consequently, to arrive at rise or fall time, one should take the rise time as equal to one quarter-cycle and the fall time as equal to two cycles of the particular frequency being considered. It is this which is the determining factor, not the rise and fall times of the keying pulse, always provided, of course, that the keying pulse is faster than the times so computed. When using the internal pulse generator this will be true; with external generators it may not be.)

4. Operational Characteristics and Precautions

When the Modulation Switch is set at "C.W.", the bleeder circuit is disconnected and the bleeder current no longer flows through the grid crystal diode. This therefore assumes a high value of resistance, removing the damping from the tuned circuit and allowing the oscillator to operate continuously, which of course corresponds to a pulse of indefinite length. Now the amplitude reached during this long pulse may quite easily be different from the amplitude set when using short pulses, for it is difficult to set the pulse flatness so accurately, by observation of the short pulses, as to guarantee that there will be no departure from flatness under the long-pulse condition. Furthermore, the damping due to the crystal is not quite the same under this condition. Consequently, the user must never attempt to ascertain the amplitude of the pulsed output wave on the basis of measurements made in the C.W. condition.

The oscillator is connected to the output circuits through a small coupling capacitor to remove the d.c. component of plate voltage of the oscillator tube, so that the voltage appearing at the output terminals will consist of r.f. only. However, it must be borne constantly in mind that the frequency spectrum of a wave consisting of the very short pulses generated by this instrument is a very broad one, extending over many tens of megacycles on either side of the carrier frequency. Analysis shows that there will be components extending all the way down into the video region. Were this not so, the instrument would not be the extremely wide-band source that it is. When it is used to test selective amplifiers or networks whose chief response is around the carrier center frequency, the video components are of course, not amplified and cannot cause any difficulty. However, there is a large class of networks which give high gains in the video region but have little or no gain in the radar I.F. region, and if the pulsed carrier output is passed through such circuits, very misleading results will be obtained. The video components will be emphasized at the expense of the output at carrier frequency, and a badly distorted picture of the output wave will be seen. A case in point would be where an attempt is made to view the pulse wave train output with a supposedly wide-band oscilloscope, having a response typical of such instruments; flat out to perhaps 10 mcs, then falling off until at 30 mcs the response is down to perhaps 5 to 10% of the low-frequency response. The wave seen on such an instrument will contain very little 30 mcs, but will instead consist of two damped wave trains, one at the start and one at the end of the pulse, their frequency being the cutoff-ring-frequency of the oscilloscope amplifier circuits. Comparison of such a result with that obtained by direct deflection of the oscilloscope beam will reveal just how bad a result can be given by a seemingly high-quality oscilloscope when used beyond its proper capabilities.

IV. MAINTENANCE

1. Pulse - Generator

The circuit of the Rada-Pulser is not complicated, and the user should encounter no particular difficulty in locating the usual type of troubles due to failure of tubes and components. The oscilloscope and the volt-ohmmeter will provide all the information necessary to trace trouble to its cause.

Begin by checking the multivibrator oscillator; it should be generating the familiar quasi-square waves. Check the blocking oscillator stage to see that it is generating the sharp, high, positive and negative triggers. Both of these stages are characterized by very definite operation; either they work properly or they quit entirely, and in this case the defective tube or component should be located and replaced. There are no critical values in this part of the instrument.

The positive B Voltage, which comes from an electronically regulated power pack, is 250 volts. This pack also supplies a negative 150 volt bias voltage, regulated by reference to the positive bus. This bias is used for a standoff voltage in the blocking oscillator and pulse-forming stages, and failure of the bias source will allow uncontrolled oscillation in either or both of these stages. The only other likely cause of uncontrolled oscillation is failure of a resistor in the biasing networks.

Operation of the pulse-forming stage in which the gas tetrode is used may not be as definite; change of characteristics in the 2D21 can cause marginal operation, poor pulse shape, failure to fire on every trigger, jitter, etc. Usually the trouble can be cleared up by replacement of the tube, but sometimes several tubes may have to be tried before one which will give entirely satisfactory operation is found. No remedy for this variability of gas tubes has as yet been found, nor have any circuit tricks aimed at making operation independent of tube characteristics been entirely successful. Yet with no other type of tube can the heavy currents which are required for broad-band performance be secured, and the user must therefore be willing to pay for the grade of performance obtained here with an occasional session of tube replacement.

The best place to connect the oscilloscope when testing the performance of the pulse-forming stage is at the normal output terminals, with the "Output" switch set to "Neg. Pulse". With the scope triggered by the pulses appearing at the "Trigger Output" terminals, both the pulse shape and the timing (jitter, etc.) are seen. For best definition of the pulse shape, direct deflection of the CR beam should be used.

2. R. F. Oscillator:

The most difficult and demanding maintenance operation of the Rada-Pulser is that of adjusting the pulsed r.f. oscillator to correct frequency and envelope shape. In most cases it should be satisfactory to adjust the center frequency on a c.w. basis, using the familiar method of beating against an accurate frequency standard. The center frequency under pulsed conditions will differ only slightly from the setting under c.w. conditions, and the slight shift will never be noticed when working with broadband circuits and amplifiers, for it will be lost in the enormous broadening of the spectrum which occurs when the carrier is pulsed. If the frequency shift is troublesome when working with narrowband circuits, it will have to be taken care of by calibrating under pulsed conditions. This is a difficult and complicated procedure, requiring special apparatus setups and a very considerable skill on the part of the user. For hints as to how to proceed, the user is referred to an article by Allan Easton which appears in the March 1947 issue of Electronics.

In order to check the pulsed carrier output for equality of amplitude of the r.f. cycles throughout the pulse, it is necessary to go to techniques giving flat operation over bandwidths of 100 megacycles or more. If suitable broadband oscilloscopes or distributed amplifiers are not available, direct deflection of the CR tube beam must be employed. Connections must all be made with coaxial cable, properly terminated. For direct deflection, the cable must extend right up to the terminals on the neck of the CR tube, with the terminating resistor located at that point. Since the duty cycle is very short (only 1 in 2000 for a .25 microsecond pulse at 2000 pps), and since the output voltage of the Rada-Pulser is quite small for direct-deflection viewing, only a small, dim image will be had at best.

With the equipment properly set up and operating from the Rada-Pulser, it should be possible to see the individual cycles in the output wave, and to determine the flatness of the pulsed wave train. If the damping of the tuned circuit is not properly set, there will be either a decrease or an increase of amplitude in the carrier cycles during the pulse. Two screwdriver-adjusted resistive shunts are located on the oscillator shied box, one for each carrier frequency; they should be adjusted individually to bring the wave train to proper flatness.

3. Use of an External Modulating Pulse Generator:

This section, while not strictly dealing with maintenance, is placed here since it contains some considerations closely related to the above adjustment procedures.

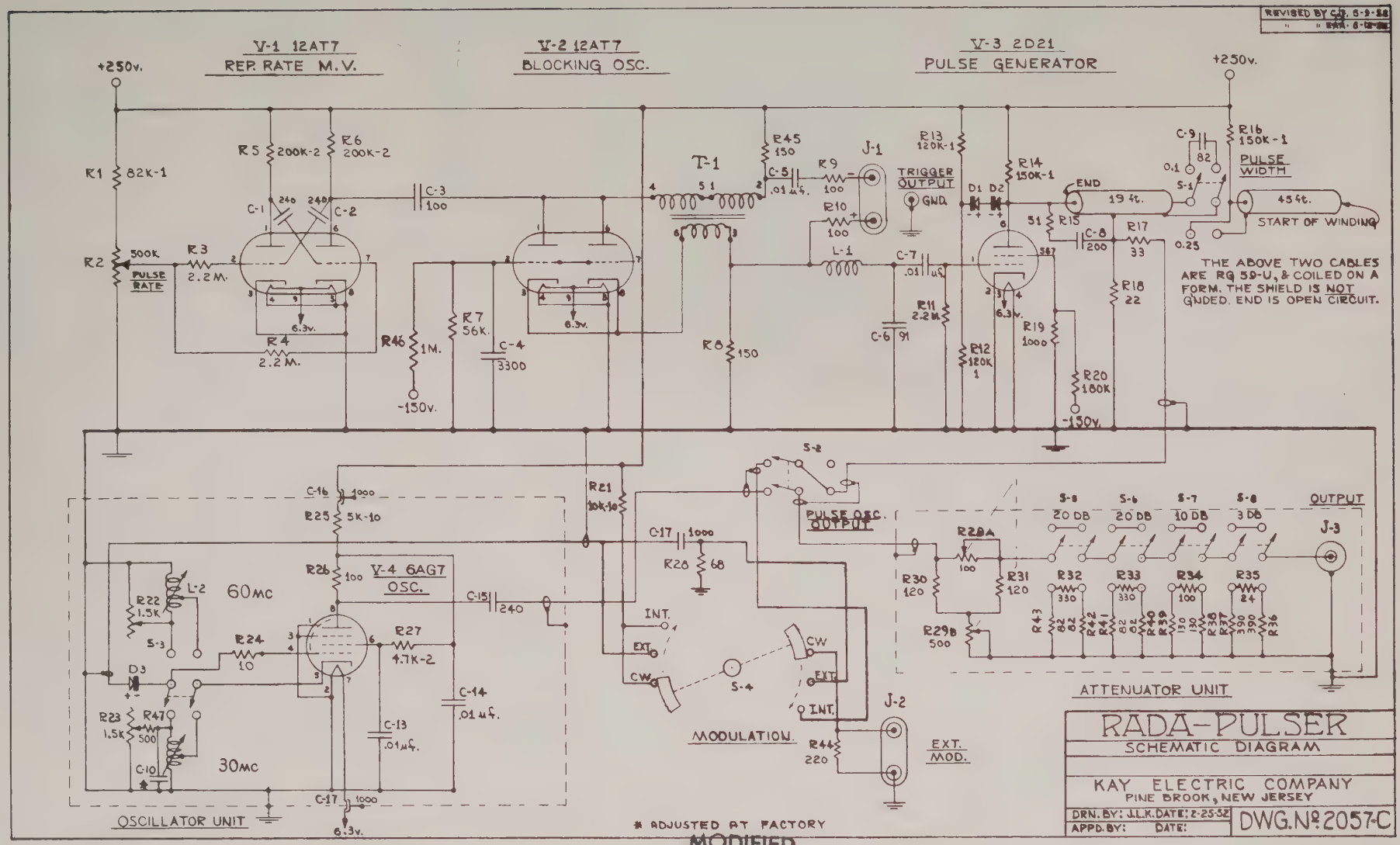
Considerable care must be exercised when attempting to use an external pulse generator to modulate the Rada-Pulser. Unless the external unit has a bandwidth very nearly equivalent to that of the Rada Pulser pulse generator, similar results cannot be obtained. Some results can be obtained, to be sure, but the user must understand the limitations in order to avoid disappointment.

Refer again to the analogy with the pendulum in order to understand where the limitations lie. The pendulum is drawn aside and held, then released. If the release is sudden and complete (in other words, if it occurs in a time very short compared to the period of the pendulum), then the first cycle of oscillation of the pendulum will have full amplitude (be without distortion). However, suppose now that the release of the pendulum is not sharp and sudden, but gradual, occurring over a time comparable with the first quarter-cycle of oscillation. Under these conditions some of the potential energy of the pendulum bob is dissipated in the restraint, and never gets into the oscillation at all; as a result, the first quarter cycle is distorted. Worst of all, the amplitude of swing is reduced, and can never equal that of the first case with the clean break. Now the same thing happens in the Rada-Pulser oscillator. With the internal pulse generator, the rise time of the keying pulse is shorter than the first quarter-cycle of the r.f. wave, corresponding to the clean and sudden release of the pendulum, and nearly all of the energy stored in the magnetic field of the coil is turned into oscillating swing. But if an external pulse generator should be used, having a rise time comparable with the time of a quarter-cycle of the r.f. wave, the release would not be clean, energy would be dissipated in the grid crystal, and the amplitude of oscillation would be reduced, the amount depending upon the rise time of the pulse. Some improvement of the situation is possible by a readjustment of the shunt damping resistors

across the tuned circuits, but it will never be possible to equal the rise characteristics of the pulsed wave train when internally modulated unless the external modulator has a comparably great bandwidth (rise time). And, obviously, when the user goes back to the use of the internal modulator, it will be necessary for him to readjust the damping, by the method outlined above in this section.

It will be noted that throughout this discussion, there has been no attempt made to speak in terms of actual rise time of the pulse, but rather an avoidance of any numerical values of rise time, with continued reference to "bandwidth". The purpose is to emphasize the fact that all rise time considerations must be referred to the period of the pulsed carrier; the absolute value of the rise time of the keying pulse has no significance by itself, but only as a frequency or a bandwidth. Also when the pulse is used to key the oscillator, only a portion of it is actually used; the actual release occurs during the first part of the rise, so that the time which is of significance is much less than the total pulse rise time as measured by the customary 10% to 90% standard. This last statement contains a significant hint for the user of an external pulse generator -- anything which can be done to improve the rate of rise of the first part of the pulse will be beneficial even though it is done at the expense of the shape of the remainder. Thus, high-pass networks consisting of series capacitors and shunt resistors, connected between the external modulating generator and the Rada-Pulser, have been found to give a distinct improvement in performance.

* * *



MODIFIED
SEE ADDENDUM
AT REAR OF BOOK

RADA-PULSER

PARTS LIST

(2/25/52)

Tubes

V-1 12AT7
V-2 12AT7
V-3 2D21
V-4 6AG7

Resistors

R1 - 82K - 1 watt
R2 - 500K - (Linear) Pulse Rate
R3 - 2.2M
R4 - 2.2M
R5 - 200K - 2 watt
R6 - 200K - 2 watt
R7 - 56K
R8 - 150 ohms
R9 - 100 ohms
R10 - 100 ohms
R11 - 2.2M
R12 - 120K - 1 watt
R13 - 120K - 1 watt
R14 - 150K - 1 watt
R15 - 51 ohms
R16 - 150K - 1 watt
R17 - 33 ohms
R18 - 33 ohms
R19 - 1000 ohms
R20 - 180K
R21 - 10K - 10 watts
R22 - 1.5K - 60 mc pot.
R23-- 1.5K - 30 mc. pot.
R24 - 10 ohms
R25 - 5K - 10 watt
R26 - 100 ohms
R27 - 4.7 K - 2 watt
R28 - 68 ohms
R29A 100 ohms)ganged variable
R29B 500 ohms)attenuation pot.
R30 - 120 ohms
R31 - 120 ohms
R32 - 330 ohms
R33 - 330 ohms
R34 - 100 ohms
R35 - 24 ohms
R36 - 390 ohms
R37 - 390 ohms
R38 - 130 ohms

Coils

L1 - 50 milli-henries
L2 - 4T Slug tuned
L3 - 6T " "

Resistors (Continued)

R39- 130 ohms
R40- 82 ohms
R41- 82 ohms
R42- 82 ohms
R43- 82 ohms
R44- 220 ohms
R45- 150 ohms
R46- 1M.
R47- 500 ohms

Capacitors

C1- 240 mmf.
C2- 240 mmf.
C3- 100 mmf.
C4- 3300 mmf.
C5- .01 mf.
C6- 91 mmf.
C7- .01 mf.
C8- 200 mmf.
C9- 82 mmf.
C10- Adjust at factory
C13- .01 mf.
C14- .01 mf.
C15- 240 mmf.
C16- 1000 mmf. - feed through
C17- 1000 mmf. - feed through

Connectors

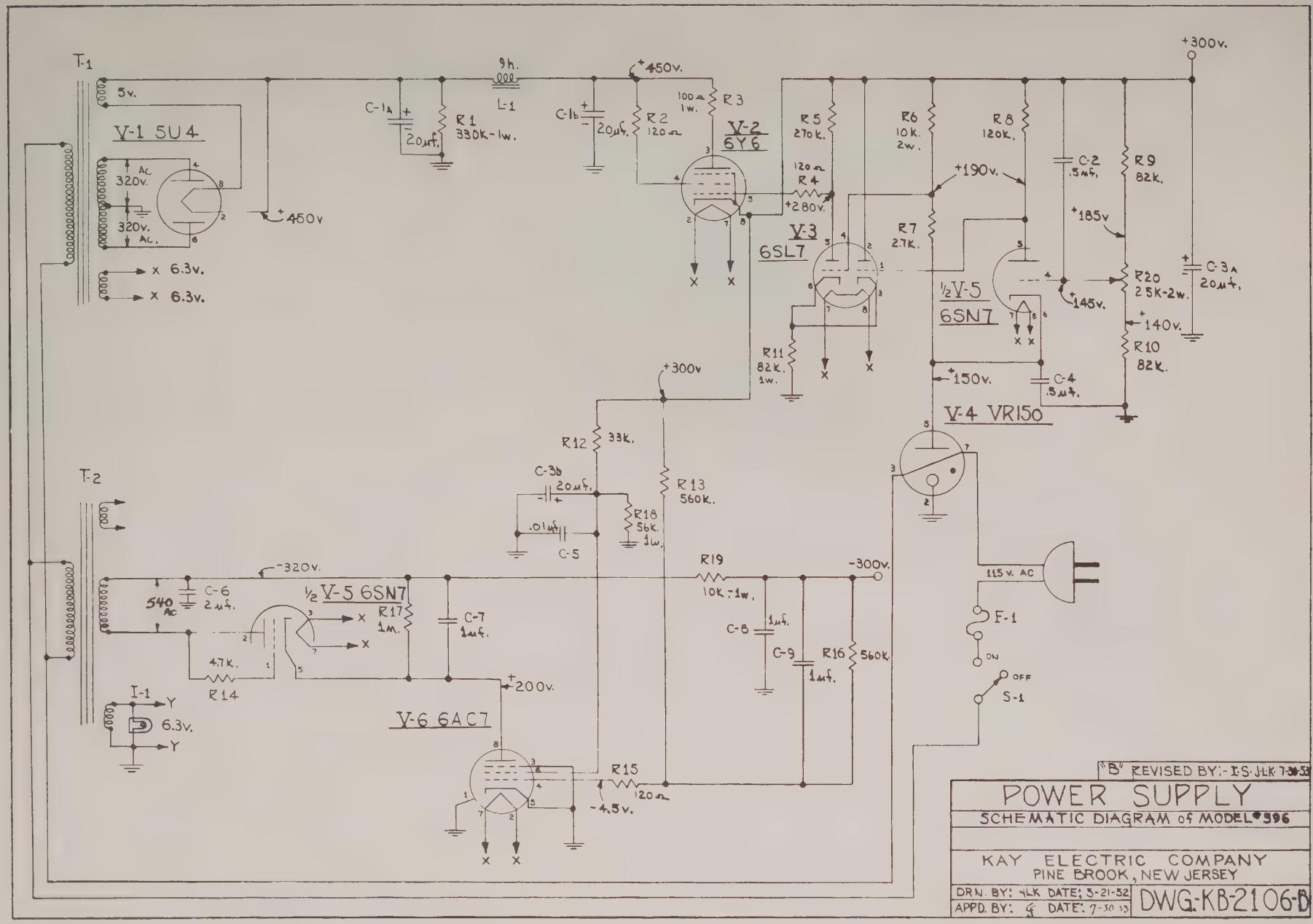
J1- Gen. Radio - Trigger Output
J2- " " - External Modulation
J3- I.P.C. - Output

Switches

S1- D.P.D.T. - Pulse Width Switch
S2- " - Pulse Osc Output Switch
S3- " - 30-60 mc switch
S4 - Rotary Switch
S5 to S8 D.P.D.T. -Attenuation Switches

Transformers

T-1 Utah #928D



"B" REVISED BY:- I.S. J.L.K. 7-30-53

POWER SUPPLY

SCHEMATIC DIAGRAM of MODEL 596

KAY ELECTRIC COMPANY
PINE BROOK, NEW JERSEY

DRN. BY: JLK DATE: 5-21-52
APPD. BY: DATE: 7-30-53

DWG. KB-2106-B

POWER SUPPLY NO. 396

PARTS LIST

Transformers

T-1	Industrial IT650A	
T-2	Industrial KP51	

Choke

L-1	9 henry, T-49699	2700 ohms	.085 ampere

Tubes

V-1	5U4	V-4	VR150
V-2	6Y6	V-5	6SN7
V-3	6SL7	V-6	6AC7

Resistors (All resistors 1/2 watt unless otherwise specified)

R-1	330,000 ohms, 1 watt	R-11	82,000 ohms, 1 watt
R-2	120 ohms	R-12	33,000 ohms, 1 watt
R-3	100 ohms, 1 watt	R-13	560,000 ohms
R-4	120 ohms	R-14	4,700 ohms
R-5	270,000 ohms	R-15	120 ohms
R-6	10,000 ohms, 2 watts	R-16	560,000 ohms
R-7	2,700 ohms	R-17	1,000,000 ohms
R-8	120,000 ohms	R-18	56,000 ohms, 1 watt
R-9	82,000 ohms	R-19	10,000 ohms, 1 watt
R-10	82,000 ohms	R-20	25,000 ohms, 2 watts Vtge. Reg. Pot.

Condensers

C-1a & 1b	20-20 μf, electrolytic, 450-450V
C-2	0.5 μf, 600V
C-3a & 3b	20-20 μf, electrolytic, 500V
C-4	0.5 μf, 600V
C-5	.01 μf, 500V
C-6	2 μf, 600V
C-7	1 μf, 600V
C-8	1 μf, 600V
C-9	1 μf, 600V

Switches

S-1	S.P.S.T.	On-Off Line

Fuse

F-1	3 amp.

Lamps

I-1	G.E. #47 Bayonet Type

V1
12AT7
REP RATE
MV

V2
12AT7
BLOCKING OSC

V3
2D21
PULSE GEN.

V4
6AG7
OSC

TRIGGER OUTPUT
GND

B+ 300V
B- -300V

R1 22K
R45 100K
RATE ADJ (INT)
PULSE RATE (EXT)
R2 500K
R3 2.2M
R4 2.2M
R5 200K 2W
R6 200K 2W
C1 150
C2 150
C3 100
R46 1M
R7 56K
C4 3300
R8 150
R9 100
R10 100
R45 150
C5 .01μf
T1
L1
C6 91
C7 .01μf
R11 2.2M
J1
R14 150K 1W
R17 270 1/4W
C8 1.5-7
R15 51 1/4W
R18 120 1/4W
R20 180K
R19 1K
C9 91
S1
19 FT CABLE
45 FT CABLE
PULSE WIDTH
START OF WINDING

C17 1000
R28 68
C16 1000
R25 5K 10W
R26 100
C15 240
R27 4.7K 2W
R24 10
C13 .01μf
C14 .01μf
C11 1000
R22 1.5K (INT)
L2
60MC
S3
D1 D2
CARRIER FREQ.
R47 510
C10 7-45
L3
30MC
R23 1.5K (INT)

S2
PULSE OSC OUTPUT
R29A 500
R30 120
R31 120
R29B 100
INCREASE (EXT)

R21 10K 10W
INT
EXT
CW
S4
MODULATION

R44 220
J2
EXT MOD

20DB
20DB
10DB
3DB
S5
S6
S7
S8
R32 330
R33 330
R34 100
R35 24
R43 82
R42 82
R41 82
R40 82
R39 130
R38 130
R37 390
R36 390
J3
OUTPUT
ATTENUATOR

B- -300V
B+ +300V
FI 3A
ON
OFF
S9
TO POWER SUPPLY
Y
FIL 6.3V AC

NOTE
UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS
ALL CAPACITANCES ARE IN μμf
* FACTORY SELECT / ADJUST

AUA SERIAL NO 2144 5

SCHEMATIC — RADA-PULSER

MAT. | FINISH: | SCALE:

DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED.
DECIMAL DIMENSIONS ± .005 FRACTIONAL DIMENSIONS ± 1/64

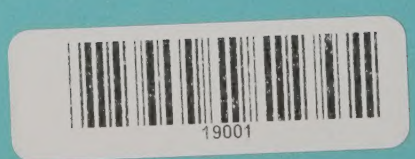
CHANGE	DATE	APP.
1st ECN No 525	9/20/60	AP

KAY ELECTRIC CO.
PINE BROOK, N. J.

DWN. BY AWPIERCE DATE 9-20-60
APP. BY M.PARCARO DATE 9-20-60

DWG. NO. KC2057F

R. B. KNAPP COMPANY, INC.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